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New records of monumental trees in the City of Bari (Apulia, Italy)

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Abstract

Monumental trees are a unique component of biodiversity that should be protected, managed, and valued just like stone monuments, historic centers, and grand architectural structures. In this paper we documented the presence of three old trees of *Cupressus cashmeriana* and one tree of *Populus nigra*, whose morphological and dendrometric parameters meets the criteria established to attribute the character of monumentality. Considering also their ecological and cultural importance, we propose the inclusion of these monumental trees in the regional and national lists.

Keywords

Conservation, Criteria for awarding monumental characters, *Cupressus cashmeriana*, *Populus nigra*, Urban biodiversity

Introduction

Traditionally trees have often been considered exclusively as a source for timber, production, and economy. Many trees, especially in urban areas, are cut down without regard to their history, size, and intrinsic value (Bottacci et al. 2007). In recent years, the growing environmental awareness has led decision makers to consider trees as sinks of

ecosystem services rather than only their productive role. Trees play a key role in urban areas by mitigating heat island, reducing runoff and infiltration of rainwater into the ground, acting as natural barriers against noise, filtering the pollution and improving the quality of life with recreational and gathering spaces. Further, individual trees of significant aesthetic, ecological, and historical-monumental value can enrich the urban landscape and even more often are catalogued as cultural heritage (Liang and Huang 2023). For these reasons both the scientific community and citizens' associations are increasingly interested in so-called "monumental trees", which are catalogued for their size, age, crown shape, location, and historical and cultural value (Lisa 2011). In Italy, the Law 10/2013 (Regulations for the development of urban green spaces) provide the definition of a monumental tree as individual trees or trees in groups that are distinguished by their remarkability, such as majesty, botanical rarity or value as a symbol of events or memories of historical, cultural or religious significance (Camarda and Brundu 2021). Trees having landscape value or those located within architectural contexts of significant historical and/or cultural reputation may also fall into the category of monumental trees (Zapponi et al. 2017)but may also result in the disappearance of rare and endangered species. Italy is currently implementing a new list of noteworthy ancient trees (i.e. monumental trees. Moreover, the above-mentioned law, implemented by the Decree of 23 October 2014, defines the list of monumental trees of Italy, establishes criteria for their census and the parameters to attribute the character of monumentality and to guarantee the protection of such specimens. The management, updating and publication of such national registry are over the responsibility of the Ministry of Agricultural, Food and Forestry Policies. Currently, several Italian regions have adopted specific regional laws for the protection of monumental trees such as Calabria, Friuli Venezia Giulia, Molise, Piedmont, Tuscany, Valle d'Aosta, and Veneto. Other regions, such as Abruzzo, Basilicata, Lazio, Liguria, Lombardy, Marche and the Autonomous Provinces of Trentino-Alto Adige, have integrated their forestry regulations with rules dedicated to the protection of monumental trees. Apulia, with a regional law of 2007, and Sardinia, through a draft of a proposed law, have dedicated special attention to the conservation of monumental olive trees. Sicily has adopted a decree to develop a register of monumental trees, without specifying methods of protection. All these regional legislations have been based to the national census of 1982 by the Italian State Forestry Corps. Such census was updated by scientific committees that classified individual trees (or groups) as monumental based on an exceptional size, unique shape, aesthetic qualities, and historical significance (Lisa 2011; Camarda and Brundu 2021).

Currently, the official Italian register of monumental trees is continuously updated according to the above-mentioned laws (Camarda and Brundu 2021; Menon et al. 2023). The most recent version of this database counts a number of 4,006 monumental trees in Italy, with approximately 90% classified as individual specimens and the remaining 10% as groups of trees (Menon et al. 2023).

The Fagaceae family and the genus *Quercus* L. are the most widely distributed across Italy. The predominant species are native, with *Quercus pubescens* Willd. being the most frequent, followed by *Fagus sylvatica* L., *Castanea sativa* Mill., *Q. ilex* L.,

Q. petrea (Mattuschka) Lieblein, *Q. cerris* L., *Q. robur* L., and *Q. trojana* Webb. Furthermore, a considerable number of non-native monumental trees are also documented, including *Platanus* L., *Cedrus* Mill., *Cupressus* L., and *Pinus* L. emerging as the most prominent genera (Menon et al. 2023).

The Apulia Region adopted the definition of monumental trees through Regional Government Resolution no. 683 of April 2, 2015, and later, with Resolution no. 1103 of June 28, 2018, providing a first regional list of 63 monumental trees.

An update by the Apulian Regional Commission for Monumental Trees certified five additional lists, increasing the number of monumental trees up to 180. Additionally, six dead monumental trees were recorded, (Campanile et al. 2020, 2023).

The most frequently occurring species in Apulian territory are *Quercus pubescens*, *Q. ilex*, *Q. cerris*, *Pinus halepensis* Mill., and *Taxus baccata* L. The province of Foggia has the highest number of monumental trees (96), followed by the provinces of Bari (44), Taranto (21), Lecce (9), Barletta-Andria-Trani (6), and Brindisi (4) (Campanile et al. 2020, 2023). In the city of Bari, a total of 5 monumental trees such as *Quercus ilex* (1), *Pinus halepensis* (2), *Phytolacca dioica* L. (1), and *Nolina parviflora* (Kunth) Hemsl. (1), the latter reported as *Nolina longifolia* (Karw. ex Schult. & Schult.f.) Hemsl. were recorded and included in the monumental trees regional list.

During our investigation carried out to survey the ornamental trees, shrubs, and succulent plants of Apulia (Venturella et al. 2024), three old trees of *Cupressus cashmeriana* Royle ex Carrière and one specimen of *Populus nigra* L. were observed in the city of Bari (Fig. 1). The study of such trees showed that their parameters meet the criteria for awarding monumental trees as determined by the Ministerial Decree of 23 October 2014. Based on these results, the aim of this paper is to propose the inclusion of these two species in the list of monumental trees of Apulia and Italy.

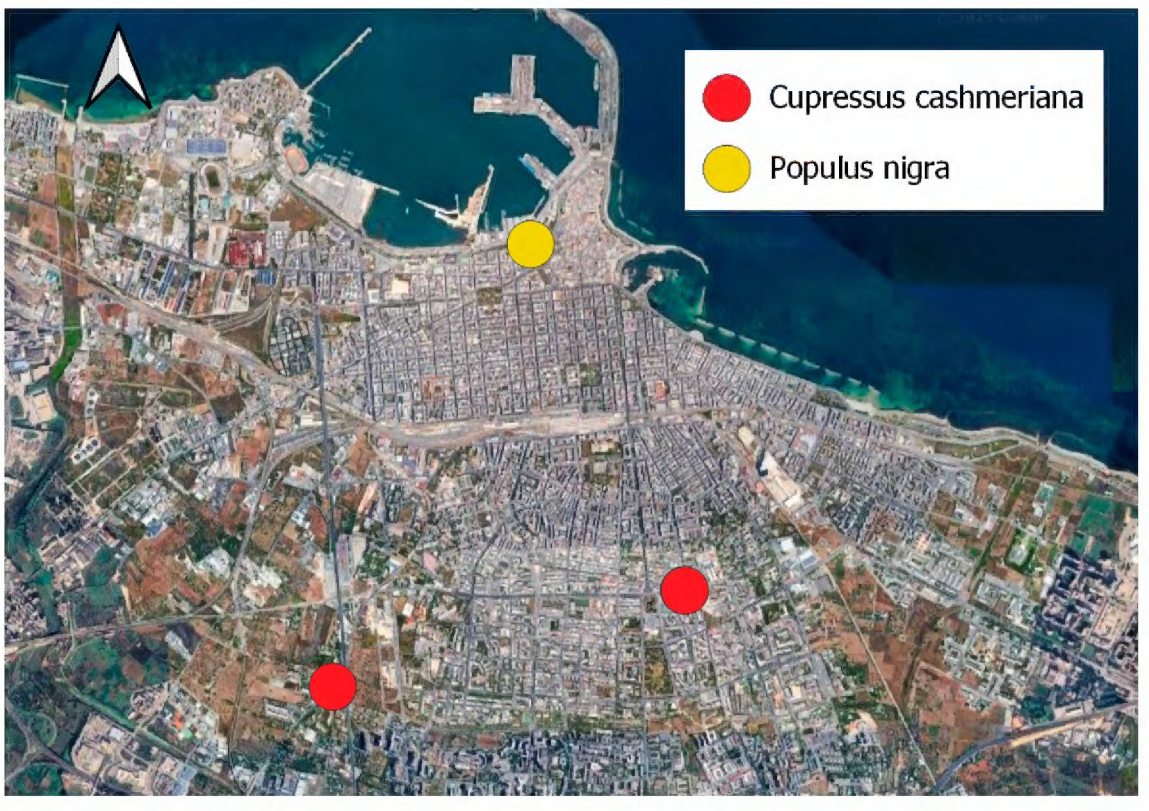

Figure 1. Localization of the plants of *Cupressus cashmeriana* and *Populus nigra* in the city of Bari.

Materials and methods

The observation of the three specimens of *Cupressus cashmeriana* Royle ex Carrière and the single individual of *Populus nigra* L. in the city of Bari (Fig. 1) were carried out in spring and autumn 2023 and 2024, respectively.

Based on the identification sheet for monumental trees or groups, as outlined in Annex 3 of the Ministerial Decree of October 23, 2014 (Ministry of Agricultural, Food and Forestry Policies), the following criteria of monumentality were examined: age, size, particular shape or habit, ecological value, plant architecture, botanical rarity, historical, cultural, and religious value, and landscape value. Additionally, the following data were evaluated: a) size for each individual or groups: number of stems, circumference at breast height (cm), estimated height (m), measured heights (m), presumed age (years), height of the first branch (m), shape and average crown diameter (m); b) vegetative and structural conditions of the individual or groups: vegetative vigor, defoliation, discoloration, microphyllia, dryness, cracks, description of symptoms/defects, condition of the root system, collar, trunk, crown, and branches, interference with structures, power lines, and targets; c) phytosanitary status of the individual tree or group of plants: infection by pests, fungal, viral, bacterial diseases, damage from grazing, fire, abiotic agents, human activities, description of symptoms, and overall phytosanitary assessment; d) cultivation and/or maintenance operations on the individual or group of trees: type of pruning, consolidation, anchoring, dendrosurgery; e) necessary interventions for the individual or groups.

Finally, for each species some other characteristics were examined, such as: taxonomic characterization (species identification using the specialized Floras such as Traverso 1926; Huxley 1992; Pignatti 2017a, 2017b, 2018; scientific binomial in accordance with the POWO database http://powo.science.kew.org/), vernacular name of the species, geographical localization (cadastral references, GPS coordinates in DDM, MGI maps, altitude, and slope), urban context (private or public green spaces), extra-urban context (forest, crops, pasture, wasteland), and the corresponding soil characteristics (GIS – Geographic Information Systems source), as well as the property and constraints (public, private ownership, or protected area) to which the species belongs.

As regards the size of the recorded species, different parameters were analyzed using different methodologies. For circumference at breast height (1.30 m from the ground), the data was collected using a metric wheel, rotating it around the trunk and directly reading the value once the circle was closed.

To determine the height of the tree and the average crown diameter, the Electronic Vertex IV BT hypsometer was used, a device that employs ultrasound and trigonometry in combination with a reflector (transponder) placed at the base of the tree. The measurement process began by calculating the horizontal distance between the observer and the tree by aiming the instrument towards the reflector. Subsequently, by directing the Vertex towards the top of the tree, the angle of inclination was recorded, and by combining it with the previously measured horizontal distance, the total height of the tree was automatically calculated using trigonometric formulas.

The estimation of the trees' age was conducted through the counting of growth rings using dendrochronological techniques, which allow for age estimation and

the study of environmental changes over time. Using a Pressler borer, a thin wood core was extracted from the tree stem (1.30 m from the ground), revealing the growth rings of the examined trees. The core was transferred to a dendrochronological laboratory where it was first dried and smoothed to improve the visibility of the rings. It was then analyzed under a stereomicroscope and measured with TSAP-Win (Time Series Analysis and Presentation for Windows), a software developed by Rinntech, specialized in analyzing tree growth rings.

Botanical and geographical features of the investigated trees

***Cupressus cashmeriana* Royle ex Carrière [Cupressaceae]**
Common name: Kashmir Cypress.

Description. large evergreen tree, up to 60 m tall. Bark red-brown, exfoliating in vertical strips. Crown broad conic to columnar with variably pendulous branchlets. Leaves dark green, in flat pendent sprouts with a white flecked resin gland. Male cones cylindrical; female cones ovoid-globose, produced singly or in clusters of up to 10 or more, dark green to brown, maturing dark blackish brown about 24 months after pollination. Seeds red-brown, with two narrow wings on the sides.

Phenology. April-May.

Geographical origin and distribution. The species is native to the easthern Himalaya in Butan and Arunachal Pradesh in India (Ray and Paria 2018). There are few evidence of the use of *Cupressus cashmeriana* in urban areas. *C. cashmeriana* is used in India for the potential mitigation action of vehicular emissions on streets (Kumar et al. 2021). On the contrary, *C. cashmeriana* is widely used as ornamental trees. In Canberra (Australia) the tree is proposed for urban parks and open places as a beautiful specimen tree or as a windbreak, while is not suitable for suburban street verges (ACT Government 2019). *C. cashmeriana* was planted in 1946 and cultivated in Headfort but the tree is now dead. Another tree is cultivated in Castlewellan (Northern Ireland) and another was cultivated in the Temperate House in Kew Garden but then removed. The only native tree is that of Dang Chu Valley, central Bhutan (easthern Himalaya). Other cultivated trees are reported for Buddhist monasteries and temples in E Nepal, Sikkim, Bhutan, Xizang (Tibet), and Arunachal Pradesh (India) (Ray and Paria 2018).

The date of its introduction in Italy is unknown and according to Galasso et al. (2024) currently no cases of spontaneization have been reported. In Italy, the Kashmir cypress is a botanical rarity, since only two large specimens are currently recorded, the first in Isola Madre (Archipelago of the Borromean Islands, Lake Maggiore, N Italy) and the other in Villa San Francesco, in the municipality of Varese (N Italy), respectively. The specimen cultivated in Lake Maggiore is included in the list of monumental trees of Italy and has become the symbol of Isola Grande, since it was uprooted by the devastating whirlwind of 2006 and has been restored thanks to an extraordinary recovery operation.

Conservation status. The tree is categorised as Near Threatened (NT) species in The IUCN Red List of Threatened Species (Ray and Paria 2018).

***Populus nigra* L. [Salicaceae]**
Common name: Black Poplar.

Description. Dioecious tree reaching up to 30 meters. Bark grey-brown in mature specimens, initially smooth, then deeply fissured. Leaves dark green, petiolate, triangular-rhomboidal, acute, serrate at the margin. Male catkins preceding the appearance of the leaves; female catkins pendent, long, and slender. The fruits are bivalve glabrous capsules; seeds small with a white cottony thistledown facilitating anemochory.

Phenology. March-April.

Geographical origin and distribution. The native range of *P. nigra* is Europe to Mediterranean and Xinjiang and includes almost all of Europe, North Africa, Caucasus, Lebanon-Syria, Anatolia and Central Asia; it also extends into Siberia (mainly Western Siberia). It is introduced in North and South America, southern part of Africa, various parts of Asia and Australia, as well as some European countries (Sweden, Denmark, and Portugal) (POWO 2025). In Italy *P. nigra* is native according to Bartolucci et al. (2024).

Conservation status. None.

Results

Cupressus cashmeriana Royle ex Carrière

A total of 3 specimens of *C. cashmeriana* were surveyed, one of them growing individually inside a private veterinary clinic and the other two growing grouped at a distance of 4 m within a traffic island divider flowerbed. These findings are new reports for Apulia.

The tree of Kashmir cypress (Fig. 2a, b) is located in the city of Bari in Via Generale Nicola Bellomo (41°06'N, 16°50'E) (Fig. 1), and falls within cadastral sheet no. 38 parcel 717, MGI map sheet 438 number 073, at an altitude of 24 m a.s.l. The tree grows in a private garden on a calcareous substrate inside the Santa Fara Veterinary Clinic. The tree meets the monumentality criteria such as age (110 years presumed), size (circumference at breast height 215 cm, estimated dendrometric height 18 m, height of the first branch 2.5 m, average crown diameter 11.22 m, crown projection 98.91 m^2), particular shape or bearing (naturalistic value related to the conical and pyramidal shape and erect bearing), and plant architecture. Regarding the estimation of the tree age, the dendrochronological analysis reveals that the main peaks occur at the years 1927 (5.6 mm), 1930 (5.3 mm), 1972 (5.2 mm), and 2002 (5.6 mm) (Fig. 3). The specimen shows good vegetative conditions and there is no evidence of defoliation, discoloration, microphyllia, and dryness. Consequently, the phytosanitary conditions are good and there are no parasite infections, fungal,

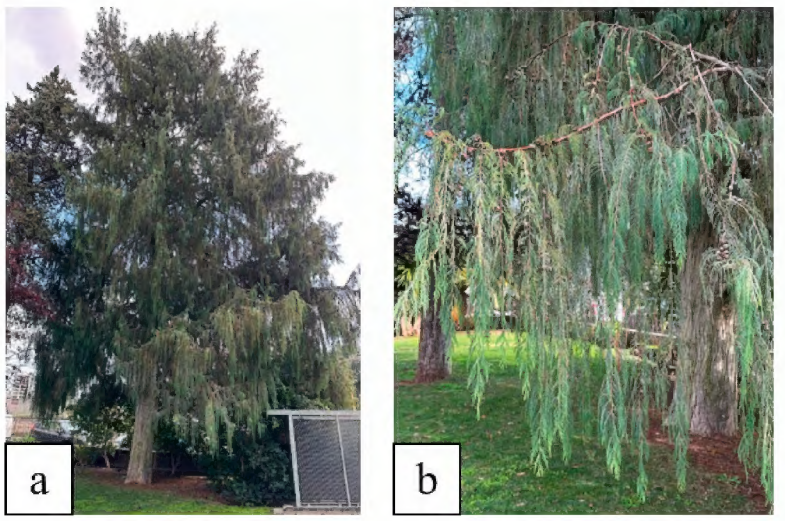

Figure 2. a tree of *Cupressus cashmeriana* (Bari) cultivated in the garden of Santa Fara Veterinary Clinic **b** details of the branches.

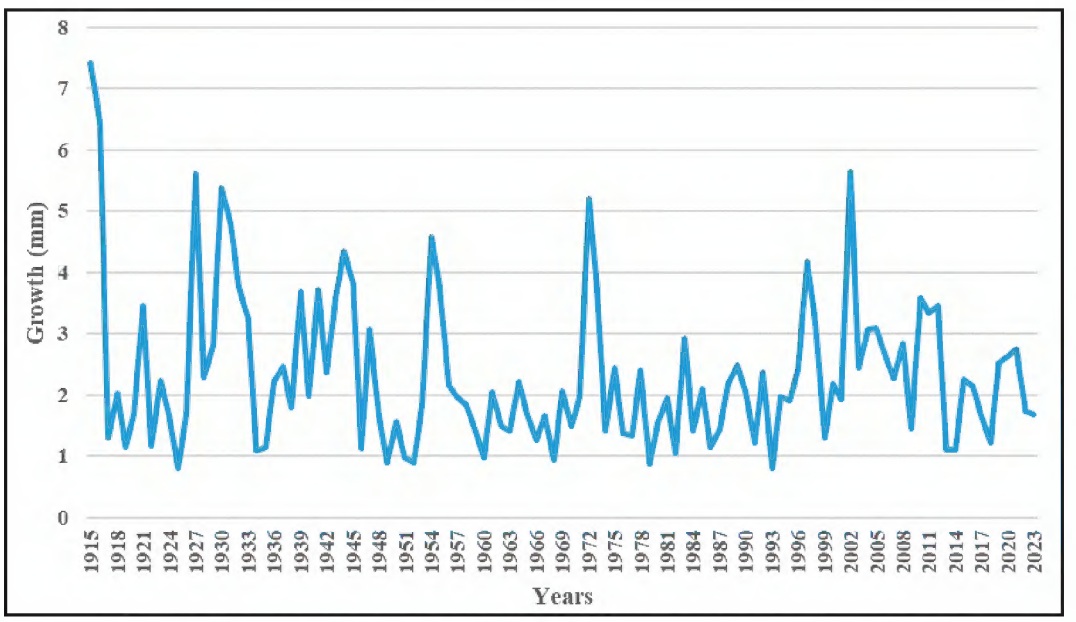

Figure 3. Radial growth of *Cupressus cashmeriana* cultivated in Via Generale Nicola Bellomo over the years.

viral or bacterial diseases. Observation of the branches does not reveal any pruning, and no specific interventions are currently required.

The group of two Kashmir cypress (Fig. 4), is located in Via Giuseppe Di Vittorio (41°06'N, 16°52'E) (Fig. 1) falling within cadastral sheet no. 14, MGI map sheet 438 number 072 at an altitude of 11 m a.s.l. The trees grow on calcareous substrate in a public green space. The two specimens meet the monumentality criteria such as age (70 years presumed), size (average circumference at breast height 160 cm, maximum specimen circumference 176 cm, average specimen height 16.5 m, maximum specimen height 16.8 m, group surface 140 m^2, height of the first branch 2.5 m), particular shape or bearing (naturalistic value related to the conical and pyramidal shape and erect bearing), plant architecture. Dendrochronological analysis shows that the two specimens have different growth rates despite growing on the same site under identical soil and climatic conditions. The specimen with the greatest height (16.8 m) and circumference at breast height (176 cm) shows radial growth peaks in

Figure 4. The group of *Cupressus cashmeriana* in Via Giuseppe Di Vittorio (Bari) **a** tree n°1 **b** tree n°2.

the years 1962 (9 mm), 1966 (7.3 mm), 1985 (6.6 mm), 1988 (6.5 mm) and 1996 (6.4 mm) (Fig. 5a). The other individual, with height 16.2 m and circumference at breast height 143 cm, shows peaks in the years 1962 (7 mm), 1978 (6.6 mm), 1982 (7.4 mm) and 1987 (6.4 mm) (Fig. 5b).

The vegetative, structural, and phytosanitary conditions of the two Kashmir cypresses in the group are good.

Populus nigra L.

The tree is located within the Isabella d'Aragona Gardens (41°07'N, 16°51'E) (Fig. 1) alongside the Norman-Swabian Castle (Fig. 6). It is included in the cadastral sheet no. 88, MGI map sheet 438 number 074, at an altitude of 5 m a.s.l. The tree grows on calcareous soil and shows monumental characters related to the age (70 years presumed), size (circumference at breast height 470 cm, estimated dendrometric height 28 m, height of the first branch 3 m, average crown diameter 12 m, crown projection 113 m^2, globose-expanded crown shape), ecological, historical, cultural, religious, and landscape value.

Concerning the estimation of the age of the tree, the dendrochronological analysis of the growth rings indicates that the main growth peaks are concentrated between 1965 and 1985, with the greatest growth (20.3 mm) recorded in 1977. Subsequently, the growth shows a rapid decline, averaging 2.1 mm over the last 20 years (Fig. 7). The vegetative condition is healthy, with optimal vigor and no defoliation, discoloration, microphyllia, and dryness, resulting in an overall positive assessment of the phytosanitary status (no parasite infections, fungal, viral or bacterial diseases). In addition, the tree has received few pruning operations, limited to the crown lifting of branches.

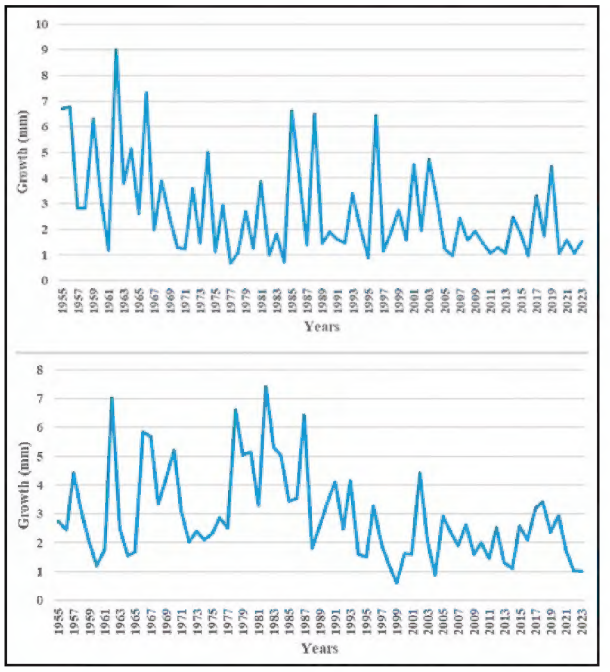

Figure 5. Radial growth of the group of *Cupressus cashmeriana* in Via Di Vittorio over the years **a** tree n°1 **b** tree n°2.

Figure 6. *Populus nigra* in Isabella d'Aragona Gardens (Bari).

Discussion and conclusions

As part of the census of ornamental plants in Apulia, we came across four trees belonging to two different species with monumental characters and high aesthetic value in the city of Bari.

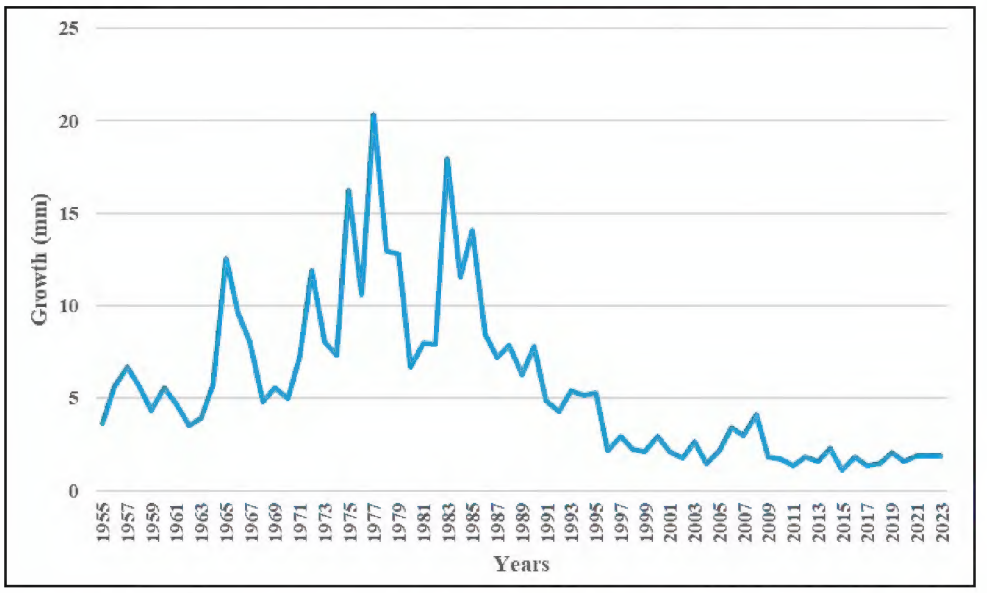

Figure 7. Radial growth of the specimen of *Populus nigra* growing in Isabella d'Aragona Gardens over the years.

These are trees that fit well into the urban context of Bari both for an aesthetic value and, in the case of the black poplar in the Isabella d'Aragona Gardens also for a historical value, suggesting a clear local "territorial identity." In particular, the black poplar has a tangible connection to the history of the Garden itself dating back to the 19th century and the neighboring Norman-Swabian Castle (1130 AD).

As for Kashmir cypresses, which are a medium rather than a low evergreen tree in nature, in cultivation they reach heights of up to 18 meters well adapted to the climatic conditions of the city of Bari despite the fact that in their places of origin they grow at altitudes between 1250 and 2670 m a.s.l. The aesthetic value of these trees is evident through their majestic bearing, hanging branches, and blue-green foliage. Adaptation to the conditions of street trees subject to pollution by vehicular traffic is also optimal considering that these plants do not present any problems by a phytosanitary point of view.

All four trees surveyed also meet at least one of the criteria of age and/or size, shape and growth habit, ecological value, floristic rarity, interest in its architectural structure, landscape quality and historical, cultural and religious value which are provided by the law no. 10/2013 and the ministerial Decree 23 October 2014.

From the data reported in this article we propose the inclusion of the *Cupressus cashmeriana* trees of Via Generale Nicola Bellomo and Via Di Vittorio and of *Populus nigra* of the Isabella d'Aragona Gardens as monumental trees for the city of Bari to be included also in the regional catalogues of monumental trees by means of regional law.

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